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㊹発明の名称　光伝送用ガラス素材の製造方法

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明　細　書

1　発明の名称　光伝送用ガラス素材の製造方法

2　特許請求の範囲

(1) ガラス微粒子の積層体を、少なくとも塩化水素と不活性ガスと酸素系ガスとを含む約1000℃の雰囲気中で加熱処理してその積層体に含まれる微量の金属イオンを除去し、該加熱処理後の積層体を、少なくとも塩素と不活性ガスと酸素系ガスとを含む約1000～2000℃の雰囲気中で加熱処理してその積層体に含まれる水分を除去し、該加熱処理後の積層体を、少なくとも不活性ガスと酸素系ガスとを含む透明ガラス化温度の雰囲気中で加熱処理してその積層体を透明ガラス化することを特徴とする光伝送用ガラスの製造方法。

(2) 不活性ガスがヘリウムからなる特許請求の範囲第1項記載の光伝送用ガラスの製造方法。

3　発明の詳細な説明

『産業上の利用分野』

本発明はガラス微粒子の積層体を加熱処理して光伝送用のガラスを製造する方法関する。

『従来の技術』

光ファイバで代表される光伝送体の場合、その素材（母材）の主たる製造方法を大別すると、VAD法、OVD法、MCVD法のようになり、これら各法により光ファイバが大規模で生産されている。

とりわけ、VAD法、OVD法はごく低ロスの光ファイバ素材が得やすく、これらに関する研究がわが国、米国で盛んである。

上記二法はスート状のガラス微粒子による積層体を形成する点で共通しており、その低ロス化は脱水の塩素による脱水技術の確立に依存するところが大きい。

最近ではSF_6を用いた脱水技術に関する研究報告、特許等が存在する。

『発明が解決しようとする問題点』

ところで、光伝送体用のプリフォームロッドにおけるOH基の量は、上述した脱水技術により、波長1.39μmにおいて殆ど認められない程に低下している。

しかし上記プリフォームロッドの場合、通信で用いる波長帯（0.85μm，1.3μm，1.55μm）に影響を与える遷移金属元素などが極微小量（ppm以下）残存しているため、究極的な最小ロス値を達成するに至っていない。

本発明は上記の問題点に鑑み、ガラス中に残存する遷移金属元素など、極微小量の金属イオンを除去することのできる光伝送用ガラス素材の製造方法を提供しようとするものである。

『問題点を解決するための手段』

本発明に係る光伝送用ガラス素材の製造方法は上記の目的を達成するため、ガラス微粒子の積層体を、少なくとも塩化水素と不活性ガスと酸素系ガスとを含む約1000℃の雰囲気中で加熱処理してその積層体に含まれる微量の金属イオンを除去し、該加熱処理後の積層体を、少なくとも塩素と不活性ガスと酸素系ガスとを含む約1000～2000℃の雰囲気中で加熱処理してその積層体に含まれる水分を除去し、該加熱処理後の積層体を、少なくとも不活性ガスと酸素系ガスとを含む透明ガラス化温度の雰囲気中で加熱処理してその積層体を透明ガラス化することを特徴とする。

『作　用』

本発明方法において処理対象となるガラス微粒子の積層体（例えばSiO_2-GeO_2 系）は、ＶＡＤ法とか、ＯＶＤ法などの任意手段で作製された多孔質母材であり、かかる積層体を上述した三つの工程で処理する。

はじめの工程では、少なくとも塩化水素と不活性ガスと酸素系ガスとを含む約1000℃の雰囲気中で上記積層体を加熱処理する。

一般に、積層体中に残存している極微小量の遷移金属などの金属イオンM は、塩素ガスを含む加熱雰囲気中において下記 (1)式の反応により飛散する。

$$M^{n\cdot} + n/2(Cl_2) \rightarrow MCl_n \text{（飛散）} \cdots\cdots\cdots(1)$$

かかる雰囲気中に塩酸が存在する場合、下記の (2) 式で明らかなように HClからH･が解離する。

$$HCL \rightleftarrows H^{\cdot} + Cl^{-} \cdots\cdots\cdots(2)$$

なお、1000℃における解離定数K_pは下記(3) 式の通りである。

$$K_p = [H^{\cdot}]\,[Cl^{-}] / [HCl] = 1.4\times10^{-4} \cdots\cdots\cdots(3)$$

HCLから解離したH･は下記式(4) のごとくM-O結合を攻撃し、結合の切れたフリーな $M^{n\cdot}$ イオンを生成せしめるので、 Cl_2のみの加熱雰囲気中で処理する場合よりも速やかに前記(1) 式の反応が起こり、重金属がほぼ完全除去される。

$$-\overset{|}{Si}-O-\underset{H^{\cdot}}{M}-O-\underset{H^{\cdot}}{\overset{|}{Si}}- \rightarrow -\overset{|}{Si}-O^{H}\ \ H_O-\overset{|}{Si}- + M^{n\cdot} \cdots\cdots\cdots(4)$$

つぎの工程では、少なくとも塩素と不活性ガスと酸素系ガスとを含む約1000～2000℃の雰囲気中で上記処理後の積層体を加熱処理してその積層体に含まれる水分を除去する。

この工程での脱水反応は周知の通りであり、前記(4) 式において生成されたOH基も、かかる脱水処理により除去される。

さらにつぎの工程では、少なくとも不活性ガスと酸素系ガスとを含む透明ガラス化温度の雰囲気中で上記両加熱処理後の積層体を加熱処理してその積層体を透明ガラス化する。

かくて、これら重金属除去工程、脱水工程、透明ガラス化工程を経ることにより、極低ロスの光伝送用ガラス素材が得られる。

『実　施　例』

以下本発明方法の実施例につき、図面を参照して説明する。

第１図において、１はＶＡＤ法を介して作製されたガラス微粒子の積層体であり、かかる積層体１は、そのコア部分が直径約20mmφの SiO_2-GeO_2 （Δ^{+}=0.3%）からなり、そのクラッド部分が外径約 110mmφのSiO_2からなる。

２は上記積層体１を処理するための処理炉（電気炉）であり、この処理炉２は石英炉心管３とその炉心管外周に設けられた電気ヒータ４とからなり、炉心管３にはガス導入口５、ガス排出口６がが設けられている。

つぎに上記処理炉２を用いて積層体１を処理す

る際の具体例につき、表1を参照して説明する。

なお、表1中において、炉温は炉心管3内における最高温部の温度、速度は炉心管3内の上部からその最高温部に向けて積層体1を降下させる際の移動速度、工程でのイは重金属除去際工程、ロは脱水工程、ハは透明ガラス化工程である。

さらに雰囲気ガス中のHCl「*」は、高純度塩酸をHe(2ℓ/min)でバブリングし、処理炉2は石英炉心管3内に導入したものである。

表　1

	工程	炉温 ℃	速度 mm/h	雰囲気ガス（ℓ/min） Cl_2	HCl	He	O_2
例1	イ	1000	250	0	*		5
	ロ	1200	150	0.5	0	50	5
	ハ	1420	150	0	0	50	5
例2	ロ	1200	150	0.5	0	50	5
	ハ	1420	150	0	0	50	5

上記各例により得られた光伝送用ガラス素材にそれぞれ同一サイズの無水合成石英管をジャケッとして、カットオフ波長 1.2μm の単一モード型の光ファイバ母材を作製し、これら各母材を加熱延伸により線引して外径 125μm φ、コア直径10μm φ、シリコーン被覆による被覆外径 380μm φの光ファイバ素線を得た。

これら光ファイバ素線の代表的なロススペクトルを第2図に示し、これらのロス平均値を表2に示した。

なお、表2での⑧は波長 1.3μm におけるロス(dB/km)を示し、⑮は波長1.55μm におけるロス(dB/km)を示す。

表　2

	例1のロス		例2のロス	
	⑧	⑮	⑧	⑮
①	0.35	0.19	0.38	0.21
②	0.33	0.17	0.40	0.23
③	0.32	0.18	0.38	0.22
④	0.35	0.19	0.35	0.19
⑤	0.34	0.18	0.38	0.22
平均	0.338	0.178	0.374	0.214

前記表1における例1の場合は、HCl,He,O_2 を含む約1000℃の雰囲気中での加熱処理、すなわち重金属除去際工程を経ているので、第2図および表2で明らかなように、ロス増が小さい。

それに対し、重金属除去際工程を経ていない例2の場合は例1よりもロス増が大きい。

このような伝送特性の優劣は前記『作用』の項で述べた理由により生じたといえる。

なお、本発明方法の具体例では不活性ガスとしてHeを用いたが、Heに代えてAr,N_2 などの不活性ガスを用いたり、二種以上の不活性ガスを混合して用いることもある。

その他、ガス酸素系ガスとしては反応性の高い発生期の酸素とか、オゾンなども有効である。

『発明の効果』

以上説明した通り、本発明方法によるときは、積層体の脱水工程、透明ガラス化工程に先行して当該積層体を、少なくとも塩化水素と不活性ガスと酸素系ガスとを含む約1000℃の雰囲気中で加熱処理してその積層体に含まれる微量の金属イオンを除去するから、究極に近いきわめて低ロスの光伝送用ガラス素材を得ることができる。

4　図面の簡単な説明

第1図は本発明方法の一実施例を略示した説明図、第2図は光ファイバのロススペクトルを示した説明図である。

1・・・ガラス微粒子の積層体

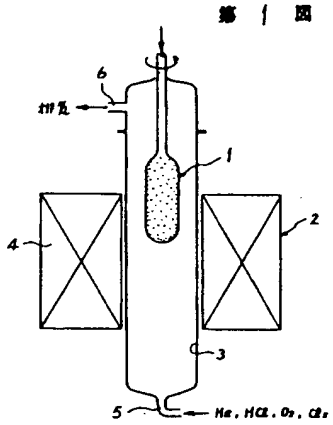
2・・・処理炉

3・・・炉心管（加熱処理雰囲気）

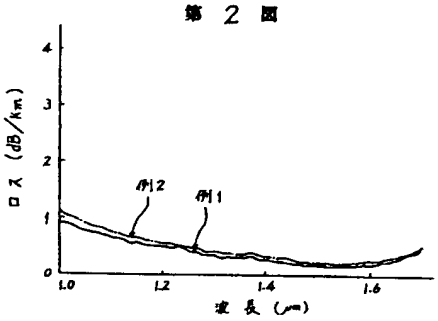
4・・・ヒータ

代理人　弁理士　斎　藤　義　雄

第 1 図



第 2 図



DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the glass substrate for plasma display panels.

[0002]

[Description of the Prior Art] Conventionally, the soda lime glass fabricated by the tabular with a thickness of 1.5-3.5mm or the glass of a high strain point is used as a glass substrate for plasma display panels. These glass substrates are usually fabricated by the float glass process excellent in smooth nature toward mass production method. On these glass, about 0.08% of the weight of the ferric acid ghost usually contains to the whole glass.

[0003] The panel of a color plasma display has the glass substrate 1 by the side of the screen shown in drawing 1 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3F%3E%3E68%3A%2F%2F%2F%26N0001%3D146%26N0552%3D9%26N0553%3D000004> , and a glass substrate by the side of the tooth back which counters this although not illustrated. On the glass substrate by the side of the screen illustrated, many two parallel display electrodes, the X electrode 5 and the Yn electrode 6, are opposite-formed. Each display electrode consists of a transparent electrode 8 and a bus electrode (metal electrode) 9. Between this parallel pole, alternating voltage is impressed and field electric discharge is performed. On a display electrode, a dielectric layer 3 and a protective layer (MgO) 4 are formed. On the other hand, although not illustrated, an address electrode is constituted in the direction which intersects perpendicularly with a display electrode, and the fluorescent substance of the red (R) and green (G) which were prepared near the electrode, and blue (B) is made to color as 1 pixel on the glass substrate by the side of the tooth back which counters this. The electrode to

which the electrode used for these plasma displays makes silver, such as a silver paste, a subject is used.

[0004]

[Problem(s) to be Solved by the Invention] However, in a float glass process, since a glass front face is exposed to hydrogen atmosphere by the forming process, a several microns reduction zone generates it on a glass front face. Therefore, if a silver paste is applied and calcinated on a glass-substrate front face and a silver electrode is formed in it, it will set to the manufacturing process of a plasma display panel, and a complex ion is spread in a glass substrate, it will be returned by the above-mentioned reduction zone and the diffused complex ion will generate the colloid of metal silver. It becomes an obstacle when coloring a glass substrate yellow and raising the brightness and contrast of image display with this silver colloid. Moreover, since the whole panel colored yellow and appeared, the problem of demoting goods worth of a panel was found.

[0005] The problem that the silver paste as an electrode will color a glass substrate It is known for the phenomenon in which the silver electrode for defrosters prepared in the rear window glass of an automobile colors a glass substrate so that it may be indicated by JP,6-34341,Y. The reducing agent which is a metal powder is put in into the coloring ceramic layer applied between a silver electrode and a substrate as this cure, and the method of preventing preventing that the silver under silver paste ionizes and silver diffusing the inside of a coloring ceramic layer, and preventing coloring of a glass substrate is learned.

[0006] However, such a method is not suitable for using for the glass substrate for plasma displays with which highly precise smooth nature is demanded. Therefore, this invention aims at offering a glass substrate for plasma display panels with little coloring which poses a problem on a display.

[0007]

[Means for Solving the Problem] this invention offers a glass substrate for plasma display panels with the hydrogen processing side which the content of a ferric acid ghost converts into Fe 2O3, and is characterized by being 0.05 or less % of the weight.

[0008] According to this invention, by controlling the content of the ferric acid ghost in the glass substrate by the float glass process below to a predetermined value, yellow coloring at the time of silver electrode formation can be suppressed, and a glass substrate for plasma display panels with little coloring which poses a problem on a display can be offered.

[0009]

[Embodiments of the Invention] Next, the gestalt of desirable operation is mentioned and this invention is explained still in detail. This invention persons found out wholeheartedly that the ion which returns the silver which constitutes an electrode in the reduction zone of the glass substrate by the float glass process was iron ion as a result of research. That is, in the glass substrate by the float glass process, as diffused Ag+ ion and the following, Fe2+ returned to this glass-substrate front face by hydrogen generates, and an oxidation-reduction reaction is started, metal silver (Ag)

generates on a glass-substrate front face, and this serves as colloid and is considered to color yellow.

Fe2++Ag+=Fe3++Ag [0010] In this invention, it is stopping the content of the ferric acid ghost of the glass substrate by the float glass process to 0.05 or less % of the weight, and found out that color tone change of the glass substrate when applying and calcinating a silver paste on a front face was suppressed. Even if the glass substrate for plasma display panels of this invention is exposed to hydrogen atmosphere like a float glass process at the time of molding and a reduction zone generates it on a front face, the color tone change when applying and calcinating a silver paste on a front face is 15 or less in degree of yellow b*. When such a glass substrate is used as a substrate by the side of the image display which forms a silver electrode, coloring by silver colloid is suppressed and the coloring which poses a problem stops being conspicuous. Of course, although it is used as a substrate by the side of the image display of a plasma display panel, even if it uses the glass substrate of this invention as a glass substrate of the opposite side of image display, it is convenient at all.

[0011] It is desirable to control glass composition by this invention so that the content of the ferric acid ghost in glass converts into Fe 2O3 and becomes 0.03 or less % of the weight more preferably 0.05 or less % of the weight. Color tone change of the glass substrate at the time of applying and calcinating a silver paste on a glass-substrate front face, and forming a silver electrode in it easily, by control of such an iron-oxide content, can be made or less into 15 by degree of yellow b*.

[0012] It is SiO2 substantially about mother composition of the glass substrate of the above-mentioned this invention in a weight % display. : 50-74aluminum2O3:0-15R2O: 6-24 (at least one chosen from R:Li and the group which consists of Na and K)

R'O: 6-24 (at least one chosen from R':Mg and the group which consists of calcium, Sr, Ba, and Zn)

It comes out and a certain thing is desirable.

[0013] In the above-mentioned composition range, the strain point of glass is 550 degrees C or more, and a glass substrate with which the coefficient of thermal expansion in 0-300 degrees C becomes 70x10-7 - 90x10-7/degree C is obtained. Since it is hard to produce irregular heat deformation and a big thermal contraction at the baking process at the time of manufacturing the substrate for plasma display panels, a glass substrate 550 degrees C or more has a desirable strain point. Moreover, since the glass frit and coefficient of thermal expansion which are usually used as a member of a plasma display panel adjust a glass substrate with which the coefficient of thermal expansion in 0-300 degrees C becomes 70x10-7 - 90x10-7/degree C and it cannot produce faults, such as deformation, easily in case it manufactures a plasma display panel, it is desirable.

[0014] Control of the content of a ferric acid ghost is explained. Usually, when carrying out commercial production of the glass, as an impurity, iron mixing is impossibly near and about 0.08% of the weight of the ferric acid ghost usually contains it to the whole glass. In glass,

although a ferric acid ghost usually exists as divalent and trivalent ion, with the glass by the float glass process, the reduction zone is formed in the glass front face, the ferric acid ghost in this reduction zone is a divalent oxide, and the problem of yellow coloring produces it at the time of formation of the silver electrode like the above. Control of an iron-oxide content is performed by using a raw material with few iron contents as a raw material which constitutes glass, or the refining raw material which lessened iron.

[0015] In addition, to the glass substrate of this invention, in order to improve the dissolution of glass, founding, or a moldability, other components, such as SO3, F, and Cl, can be added in 2 or less % of the weight of the range with a total amount. Moreover, in order to raise the chemistry endurance of glass, other components, such as B-2s La [O3 ZrO2, and] 2O3, and TiO2, SnO2, ZnO, can be added in 5 or less % of the weight of the range with a total amount.

[0016] The glass substrate for plasma displays of this invention is not limited to the panel structure where it is explained with the composition of drawing 1 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3F%3E%3E68%3A%2F%2F%2F%26N0001%3D146%26N0552%3D9%26N0553%3D000004> mentioned above, and should just calcinate a silver paste on the front face. As shown in drawing 1 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3F%3E%3E68%3A%2F%2F%2F%26N0001%3D146%26N0552%3D9%26N0553%3D000004> , the silver paste may be formed on the substrate through the transparent electrode, and may be formed on the direct substrate. Moreover, you may be a glass substrate not only the glass substrate by the side of the screen which has the transparent electrode shown in drawing 1 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3F%3E%3E68%3A%2F%2F%2F%26N0001%3D146%26N0552%3D9%26N0553%3D000004> but for the tooth-back boards which are not illustrated.

[0017]

[Example] Next, an example is given and this invention is explained still more concretely.

The raw material of example 1 each component was prepared so that it might become a target system, and it melted at 1550 degrees C using the platinum crucible. Subsequently, it was begun to pour dissolution glass and cooled slowly after fabricating to a tabular. The obtained sample was heat-treated in 5 minutes and under 10% hydrogen atmosphere (nitrogen balance) at 725 degrees C, and the front face was made to generate a reduction zone. Then, the silver paste was printed on the glass front face, it calcinated at 580 degrees C after that for 1 hour, and color tone change of the glass in baking order was measured.

[0018] Composition of the glass obtained in this way and the color tone change by silver colloid are shown in Table 1. The mother glass composition in Table 1 is as being shown in Table 2. Color tone change is expressed with the L*a*b* color coordinate system. From this, coloring by

silver colloid is suppressed and b* showing the degree of yellow becomes small as Examples 1-4 and content iron quantity are reduced. In order to make degree of yellow b* or less into 15, it turns out that it is required to stop a ferric acid ghost content to 0.05 or less % of the weight.

[0019]

[Table 1]

Table 1

[0020]

[Table 2]

Table 2

[0021]

[Effect of the Invention] According to this invention, a glass substrate for plasma display panels with little coloring which poses a problem on a display is obtained.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3F%3E%3E68%3A%2F%2F%2F%26N0001%3D146%26N0552%3D9%26N0553%3D000004> The outline block diagram showing an example of the glass substrate for plasma display panels of this invention.

[Description of Notations]

1: Glass substrate (screen side)

3: Dielectric layer

4: Protective layer

5: X electrode

6: Yn electrode

8: Transparent electrode

9: Bus electrode (metal electrode)

[Translation done.]

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CLAIMS

[Claim(s)]

[Claim 1] A glass substrate for plasma display panels with the hydrogen processing side which the content of a ferric acid ghost converts into Fe 2O3, and is characterized by being 0.05 or less % of the weight.

[Claim 2] Composition of glass is SiO2 substantially by weight % display. : 50-74aluminum2O3:0-15R2O: 6-24 (at least one chosen from R:Li and the group which consists of Na and K)

R'O: 6-24 (at least one chosen from R':Mg and the group which consists of calcium, Sr, Ba, and Zn)

The glass substrate for plasma display panels according to claim 1 which it comes out, and it is, and the content of a ferric acid ghost converts into Fe 2O3, and is 0.05 or less % of the weight.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] About the conductive baking object mainly used for a discharge-in-gases display panel (a plasma display panel, PDP), further, this invention has low electric resistance in a detail, and relates to the good conductive baking object of the contrast of a color tone. Moreover, it is related with the electrode which consists of this conductive baking object, the alternated type discharge-in-gases display panel which uses this electrode for a row as a bus electrode, and the flowed-in one direction type discharge-in-gases display panel similarly used as an anode plate.

[0002]

[Description of the Prior Art] The alternated type and the flowed-in one direction type discharge-in-gases display panel are well-known. For example, the typical basic structure of an alternated type discharge-in-gases display panel is as being shown in drawing 1 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3E%3C76%3C%2F%2F%2F%26N0001%3D727%26N0552%3D9%26N0553%3D000011> . In addition, drawing 1 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3E%3C76%3C%2F%2F%2F%26N0001%3D727%26N0552%3D9%26N0553%3D000011> is the perspective diagram having shown notching and the interior for this panel, in order to show the important section of this basic structure.

[0003] According to this structure, have predetermined space, the screen side substrate 1 which consists of translucency material like glass, and the tooth-back side substrate 2 are made to

counter mutually, and it constitutes, and has structure which enclosed rare gas with this space as a discharge gas.

[0004] In the screen side substrate 1, the electric discharge maintenance electrode pair of a large number which consist of an electric discharge maintenance electrode of an parallel couple mutually which consisted of a transparent electrode 3 and a bus electrode 4 and which is prolonged in a longitudinal direction is prepared, and they are covered by the transparent dielectric layer 5 and the still more transparent protective layer 6. The address electrode 8 of a large number which intersect perpendicularly with the above-mentioned electric discharge maintenance electrode pair is formed in the tooth-back side substrate 2 similarly covered by the dielectric layer 7. A display is performed in the intersection of these electric discharge maintenance electrode pair and the address electrode 8, or its near by demarcating an electric discharge cell, making each [these] electric discharge cell discharge alternatively, and making a fluorescent substance 10 emit light by the septum 9.

[0005] As the formation method of an electric discharge maintenance electrode, a transparent electrode 3 Throughout the whole surface of the screen side glass substrate 1, for example, an ITO (indium-stannic-acid ghost) film or a Nesa (tin oxide) film It forms beforehand by methods, such as a vacuum deposition method and a spatter. After that, A desired electrode pattern is formed by applying a photoresist, carrying out etching processing, where the part which forms this transparent electrode by exposure and development is protected, and finally removing a photoresist.

[0006] The bus electrode 4 is obtained by performing baking, after forming a pattern by screen-stenciling the paste containing conductive metal powders, such as silver, gold, and aluminum. Or a desired pattern is formed by applying a photoresist after that, carrying out etching processing, where the part which forms this bus electrode is protected, forming metal membranes, such as chromium and copper, by methods, such as sputtering, throughout the whole surface of the screen side glass substrate after transparent-electrode formation, and finally removing a photoresist by exposure and development.

[0007] As a transparent substrate, a glass substrate is the most common. As a material to be used, as a method of forming an electrode and wiring on a glass substrate, various methods, such as the phot lithography method besides the above-mentioned screen printing and the photoresist method, the lift-off method, or the method of etching after screen-stencil, are mentioned, and electric resistance is low, and since a manufacturing cost is also cheap, silver is common.

[0008] however, the case where silver is used -- baking, after pattern formation -- the interface of silver and a glass substrate -- silver white -- or ocher is presented silver white -- the end of silver dust -- a binder like the end of a glass powder -- ** -- it is the own color of a thick film which both sintered and was obtained, and in case ocher manufactures a glass substrate in the end of silver dust by the end of a glass powder which is a binder, and the float glass process, it is a color produced by the reaction of the tin which adheres and exists in the bottom side of this substrate

[0009] Thus, when the glass substrate in which the electric discharge maintenance electrode containing a bus electrode was made to form is used as a screen side substrate of a discharge-in-

gases display panel, it has big influence on color specification quality. That is, if this bus electrode presents silver white, since outdoor daylight will be reflected, if the contrast of a display falls and ocher is presented, the color tone of color display shifts from an original color tone, and the whole display screen will wear the yellow taste and it will be visible.

[0010] As an example of the cure, the method of making a black paste film placed between the interfaces of a silver thick film and a glass substrate is proposed (JP,6-12987,A). However, by such method, although display contrast is raised, a process will become complicated and a manufacturing cost will rise. Moreover, by mixing and pasting black pigment as an option in the end of silver dust, a baking object is made to wear a blacking wash and there is also the method of making reduce reflection of outdoor daylight and improving display contrast. However, by this method, if the amount of black pigment is little, it being in an uneven state and sufficient effect will not be acquired. Therefore, generally most quantity of black pigment will have to be added, consequently electric resistance will rise sharply. In order that the front face of a baking object may furthermore also wear black, the light generated within the display cell will be absorbed.

[0011] On the other hand, if aluminum, nickel, etc. are used as a conductive metal powder, since resistance will become high sharply as compared with silver, it is not desirable.

[0012] Although resistance will become low if copper is used, since an oxidizing atmosphere is required for the process which forms following guidance **** and a following septum, the bus electrode of the copper which was formed by suitable methods, such as sputtering, in the case of the discharge-in-gases display panel oxidizes at the process, and serves as a copper oxide. Therefore, in order to protect a copper electrode from oxidization, after forming a protective layer in the front face, it is necessary to progress to the following process. Moreover, the color tone of the display screen shifts like the case where silver is used, and a copper electrode needs to form a bus electrode for the material which presents black, such as chromium, in piles as a ground as the cure, in order to present copper color. Thus, since the bus electrode which consists of a multiplex layer is formed when using copper, a process will become very complicated and a manufacturing cost will rise.

[0013] The above can completely say the same thing also about formation of the anode plate in a flowed-in one direction type discharge-in-gases display panel, although it is the example of formation of the bus electrode in an alternated type discharge-in-gases display panel.

[0014] Electric resistance is low, and after taking the measures to the above-mentioned trouble in order to have formed these electrodes when the manufacturing cost was taken into consideration, the method of using silver is the most desirable. Especially, since the screen size's being increasingly enlarged in a discharge-in-gases display panel from now on and structure tend to turn minutely more, it is necessary to make resistance of an electrode or wiring still lower. Moreover, they are not only industrial use but requirements with a low manufacturing cost very big in order to take and replace the conventional CRT, projection type TV, etc. as a noncommercial use.

[0015]

[Problem(s) to be Solved by the Invention] The purpose of this invention is offering the conductive baking object conductivity and many properties of whose fitted the method advantageous to formation of an electrode for discharge-in-gases display panels like screen-stencil, and solved the problem of the above color tones and the absorption of light, and were stable. Moreover, other purposes of this invention are offering the alternated type discharge-in-gases display panel which uses such a conductive baking object as a bus electrode, and the flowed-in one direction type discharge-in-gases display panel used as an anode plate.

[0016]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, as a result of repeating examination, by using the conductive baking object which calcinated the organic compound which contains the above-mentioned metal atom as an electrode in addition to the powder of silver, gold, or an octavus group metal, and the end of a glass powder, and the constituent which blended and obtained the vanadium oxide, this invention persons find out that the technical problem can be solved, and came to attain this invention.

[0017] That is, this inventions are at least one sort of metal powders chosen from (A) silver, gold, and octavus group noble metals.;

(B) The end of a glass powder;

(C) the conductive baking object which calcinates the constituent which contains the (D) vanadium oxide in the organic compound; row which contains in a molecule at least one sort of metal atoms chosen from silver, gold, and octavus group noble metals, and is acquired -- being related --; -- again The bus electrode which consists of this conductive baking object; The substrate of the couple which carries out phase opposite on both sides of discharge space at a row, The electric discharge maintenance electrode which is prepared in the inside of one [at least] substrate, and consists of a transparent electrode and a bus electrode, And the alternated type discharge-in-gases display panel equipped with the dielectric layer prepared one by one inside this electric discharge maintenance electrode, and the protective layer; The substrate of the couple which carries out phase opposite on both sides of discharge space at a row, In the flowed-in one direction type discharge-in-gases display panel equipped with the anode plate prepared in the inside of one [at least] substrate, and the cathode prepared in the inside of the substrate of another side, it is related with the discharge-in-gases display panel characterized by being the electrode which this bus electrode or this anode plate turns into from the above-mentioned conductive baking object.

[0018]

[Embodiments of the Invention] Since the (A) component used for the conductive baking object of this invention may give conductivity to this baking object, and one sort or two sorts or more are sufficient as it, it is the metal powder, the mutual mixture, or the alloy chosen from silver, gold, a ruthenium, a rhodium, palladium, an osmium, iridium, and platinum and gives the conductivity which was desirable, and was excellent, especially its silver is desirable. [of

conductivity and economical efficiency to the silver, palladium, its mutual mixture

[0019] Although the piece-like of Lynn is sufficient even if the configuration of a metal powder is spherical, when forming a pattern by screen-stencil, a spherical thing is desirable from the outstanding print quality being obtained. particle size -- usually -- 0.05-5 micrometers it is -- 0.1-3 micrometers It is desirable. 0.05 micrometers In the following, oil absorption is too large and it is hard to prepare a printability, and a contraction is too large in the case of baking, and it is easy to generate a crack. On the other hand, it is 5 micrometers. If it exceeds, a degree of sintering is bad, and an accurate printing line will not be obtained except that an electric resistance value becomes high.

[0020] (B) While promoting sintering between the (A) components by contributing as adhesives on which a conductive baking object and a substrate are pasted up, and softening further the glass-powder end of a component in the case of sintering, it is effective in bringing together the metallic oxide which exists in a constituent in a substrate side. As the end of a glass powder, a hoe silicic-acid lead system, a hoe silicic-acid bismuth system, a HOUKEI acid zinc system, Glass frits, such as a HOUKEI acid alkali-metal system, a HOUKEI acid alkaline-earth-metal system, a boric-acid lead system, and a silicic-acid lead system, are illustrated, a dielectric approaches an electrode like a discharge indicator tube, and since it is calcinated and formed Usually, a thing 600 degrees C or less is used for softening temperature by that are the temperature which does not affect it to them, and it can calcinate at the temperature to which a panel is not distorted, and a thing 580 degrees C or less is desirable from it. especially a configuration is limited -- not having -- particle size -- usually -- 0.1-10 micrometers it is -- 0.2-5 micrometers It is desirable.

[0021] since the above-mentioned effect is fully acquired small [the electric resistance of the baking object acquired] enough, the loadings of the (B) component in the constituent with which baking is presented receive the (A) component 100 weight section, its 0.1 - 15 weight section is desirable, and its 0.5 - 10 weight section is still more desirable

[0022] (C) The organic compound which contains the metal atom of a component in a molecule is a characteristic component for solving a color tone and the absorption of light with the vanadium oxide of the (D) component in the electrode which consists of the conductive baking object and this baking object of this invention.

[0023] (C) since a conductive baking object can be formed by baking in the atmosphere, the metal atom contained in the molecule of a component is at least one sort chosen from silver, gold, a ruthenium, a rhodium, palladium, an osmium, iridium, and platinum, and even if the same as the metal of the (A) component, they may differ At least one sort chosen from a viewpoint of economical efficiency and resources protection by silver, palladium, and the ruthenium is desirable. As such an organic compound, an organic-acid metal salt, a metal alkoxide, and the metal chelate complex that the metal atom has combined with the organic machine through an oxygen atom and/or a nitrogen atom are mentioned. As an organic-acid metal salt, formic-acid silver, a silver acetate, propionic-acid silver, butanoic acid silver, Pentanoic-acid silver, hexanoic-acid silver, oenanthic-acid silver, octanoic-acid silver, decanoic-acid silver, Dodecanoic acid silver, tetradecanoic acid silver, stearin acid silver, acrylic-acid silver, Fatty-

acid silver of the shape of a straight chain like methacrylic-acid silver and oleic acid silver, and the letter of branching; Benzoic-acid silver, Aromatic organic-acid silver; and oxalic acid silver like phthalic-acid silver, malonic-acid silver, succinic-acid silver, adipic-acid silver, multiple-valued organic-acid silver like maleic-acid silver, etc.; the organic-acid palladium salt corresponding to these, an organic-acid ruthenium salt, etc. are illustrated by the row. A silver alkoxide like silver tetrapod butoxide, silver tetrakis (hexyl oxide), and silver tetrakis (octyl oxide) as a metal alkoxide; a palladium alkoxide, a ruthenium alkoxide, etc. corresponding to these are illustrated by the row. Silver chelate complexes, such as a silver beta-diketone complex like silver acetylacetonato, silver methyl aceto acetate, silver ethyl aceto acetate, and silver butyl aceto acetate as a metal chelate complex; the palladium chelate complex corresponding to them, a ruthenium chelate complex, etc. are illustrated by the row.

[0024] Electric resistance is small, since the color tone of the interface of an electrode and a glass substrate is fully black, the loadings of the (C) component in the constituent with which baking is presented are converted into the metal atom in the (C) component to the (A) component 100 weight section, its 0.5 - 20 weight section is desirable, and its 1.0 - 15 weight section is still more desirable.

[0025] (D) The vanadium oxide of a component has the white upper surface of the baking object which sintering of the (A) component was promoted in the baking process of a constituent, and the ** (A) component carried out the segregation to the upper layer of a baking object, was made to form a baking object so that a residual component may form a lower layer, and was acquired by existence of the (C) component, and is a component from which it is made for a tooth back to become the dark color. As such a vanadium oxide, it is V2 O3 and V2 O4. And V2 O5 It is illustrated.

[0026] since the above-mentioned effect is fully acquired small [the electric resistance of the baking object acquired] enough, the loadings of the (D) component in the constituent with which baking is presented receive the (A) component 100 weight section, its 0.05 - 5 weight section is desirable, and its 0.1 - 2 weight section is still more desirable

[0027] in this invention, in order to heighten the effect of the (C) component and the (D) component, and the above-mentioned effect concerning the color tone of a baking object further conjointly, you may blend further the metallic oxide which is except the (D) component as a (E) component This metallic oxide may have thermal resistance within the temperature requirement to which a glass substrate is exposed in the manufacture process of a discharge-in-gases display panel, and what thing is sufficient as it as long as it is stable. As such a (E) metallic oxide, metal multiple-oxide Cr-Co-Mn-Fe, Cr-Cu, Cr-Cu-Mn, Mn-Fe-Cu, Cr-Co-Fe;(FeO) x(Fe 2O3) y, etc. are illustrated, and two or more sorts may be used together at least one sort. The ferric acid ghost expressed; MnO2 ; MoO2 ; Cr 2O3 ; CuO;PdO;RuO2 ; Bi 2O3 Although what presents black or a dark color is desirable and especially the thing that presents black is desirable in order for a color tone on the back to acquire a good baking object, you may use what presents the other color with combination with the (C) component and the (D) component. Especially a configuration is not limited but can use the thing of any configurations, such as the shape of a globular shape and a piece of Lynn, a needle, and an unfixed configuration. particle size -- usually -- 0.01-5

micrometers desirable -- 0.02-2 micrometers it is .

[0028] (E) Although they can be arbitrarily set up according to the design of a discharge-in-gases display panel, since the loadings of a component satisfy both color tones of the interface of electric resistance and an electrode, and a glass substrate, do not absorb the light generated within the display cell and do not have a bad influence on the workability in the case of the pattern formation by screen-stencil etc., its 0.5 - 20 weight section is desirable to the (A) component 100 weight section, and its 1 - 15 weight section is still more desirable.

[0029] Blend the (E) component blended if needed [above / (A) - (D) component and if needed] with the vehicle which consists of for example, an organic resin and an organic solvent, suitable kneading machines, such as a stone milling machine, a ball mill, and 3 roll mills, are made to distribute, and the constituent for acquiring the baking object of this invention is obtained by preparing in the configuration of a paste.

[0030] although the organic resin used for the above-mentioned paste changes also with the formation method of a pattern, or arts -- the process of baking -- volatilization -- or -- pyrolyzing -- baking -- it is suitably chosen as the inside of the body from the thing which does not make carbide remain As such an organic resin, a methyl cellulose, an ethyl cellulose, A cellulose system resin like a nitrocellulose, cellulose acetate, a cellulose propionate, and a butanoic acid cellulose; (meta) A methyl acrylate, An ethyl acrylate, an acrylic-acid (meta) isopropyl, acrylic-acid (meta)-n-butyl, (Meta) Isobutyl acrylate, acrylic-acid (meta)-2-ethylhexyl, (Meta) (Meta) poly (meta) acrylic-esters; like polymers, such as acrylic-acid-2-hydroxyethyl, and a copolymer -- polyvinyl alcohol; -- the Polly alpha methyl styrene, a polybutene, etc. are illustrated

[0031] It is the organic solvent of this organic resin. as a dispersion medium of a constituent Toluene, a xylene, ethylbenzene, a diethylbenzene, an isopropylbenzene, Aromatic hydrocarbons, such as amyl benzene, p-cymene, a tetralin, and petroleum system aromatic-hydrocarbon mixture; Menthol, Terpene alcohols, such as all [KARUPE / a terpineol and], a borneol, and a menthonaphtene diol; A 2-methoxyethanol, The 2-ethoxyethanol, 2-butoxy ethanol, the diethylene-glycol monomethyl ether, Ether alcohols, such as a diethylene glycol monoethyl ether and the diethylene-glycol monobutyl ether; Ethylene-glycol-monomethyl-ether acetic ester, Ether ester, such as ethylene-glycol-monoethyl-ether acetic ester and ethylene-glycol-monobutyl-ether acetic ester; even if ketones, such as a methyl isobutyl ketone, are illustrated by the row and it is independent, two or more sorts of mixture is sufficient. In 25 degrees C, usually, 20 to 500 Pa-s, the case of the apparent viscosity suitable for the pattern formation method of the following [concentration / of a constituent], for example, screen-stencil, can be arbitrarily defined by the pattern formation method so that the paste of the range of 100 - 300 Pa-s may be obtained preferably.

[0032] Furthermore, a plasticizer, a defoaming agent, a dispersant, a leveling agent, a photosensitive monomer, a polymerization initiator, a polymerization inhibitor, a sensitizer, a stabilizer, an adhesion accelerator, etc. can be blended with the paste used for this invention as an additive if needed. As a plasticizer, phthalic esters, glycolic-acid ester, phosphoric ester, sebacic acid ester, adipates, and citrates can be used among these. Moreover, an acrylic ester etc. can be

used as a photosensitive monomer used for a photosensitive vehicle.

[0033] Thus, the obtained paste is printed or applied to a base-material front face, and a pattern is made to form. As the pattern formation method, screen printing, the phot lithography method, the lift-off method, the etching method, etc. are illustrated. Thus, from the paste which had the pattern formed in a base-material front face, after removing an organic solvent by conventional methods, such as air-drying, it calcinates for 10 - 30 minutes at 500-580 degrees C, and the conductive baking object of this invention is formed in a base-material front face. In addition, in the case of the etching method, after forming a pattern by exposing and developing a photopolymer on a baking object, etching processing is performed using a suitable etching agent, at the end, in the photopolymer which remained, it exfoliates and the conductive baking object by which pattern formation was carried out is acquired.

[0034] The electrode which consists of a conductive baking object of this invention by such method using the above-mentioned constituent is obtained. Especially, the bus electrode of the alternated type discharge-in-gases display panel of the above-mentioned structure or the anode plate of a flowed-in one direction type discharge-in-gases display panel is made to form, and the alternated type of this invention or a flowed-in one direction type discharge-in-gases display panel is obtained. In addition, as for the component of others in a discharge-in-gases display panel, a substrate, a transparent electrode, a dielectric layer, a protective layer, a fluorescent substance, an address electrode, cathode, etc. can use a well-known material and the formation method from the former.

[0035]

[Effect of the Invention] The baking object of this invention can have low electric resistance, and it can be made for a blacking wash to be effectively tinctured with the color tone of the interface of a baking object and a glass substrate. Moreover, many properties, such as the printing nature of a paste, are excellent. If this uses for the screen side substrate of a discharge-in-gases display panel, forming it in it as a bus electrode or an anode plate, since a black stripe-[electric resistance / not only a low but] effect will be acquired, the reflection factor of outdoor daylight stops and the problem on display quality, such as a fall of the display contrast generated when powder, such as silver metallurgy, is only used, and a gap of a color tone displayed, can solve conventionally. Since it is moreover hard to absorb the light generated within the display cell, the light equivalent to the electrode is reflected in a cell, and only the part can make a fluorescent substance emit light more effectively. Furthermore, such an electrode can be formed cheaply and easily by this invention. Moreover, the baking object of this invention can be applied to the wiring formed in a glass-substrate front face like an electrode, electric resistance is low, it can be easy and the discernment in the naked eye from a rear face can form easy wiring cheaply.

[0036] The alternated type discharge-in-gases display panel using the electrode obtained by this invention as a bus electrode and the flowed-in one direction type discharge-in-gases display panel used as an anode plate have the outstanding electric discharge property and a very useful display property from being obtained easily industrially.

[0037]

[Example] Hereafter, an example and the example of comparison explain this invention to a detail more. In the section, in these examples, % of the weight section and composition shows weight %. this invention is not limited by these examples.

[0038] the end of an example 1 - the end of 5 silver dust (0.5 micrometers of mean particle diameters, spherical particle), and a glass powder (HOUKEI acid lead glass --) About 480 degrees C of softening temperatures, 3 micrometers of mean particle diameters A spherical particle, 2-ethyl hexanoic-acid palladium (palladium 22% per part), V2 O4 Powder (2 micrometers of mean particle diameters, indeterminate form particle) CuO powder (3 micrometers of mean particle diameters), and Bi 2O3 Powder (5 micrometers of mean particle diameters) was prepared with the compounding ratio as shown in Table 1. It pasted by kneading with a kneading machine with the organic vehicle which dissolved the ethyl cellulose in ethylene-glycol-monobutyl-ether acetic ester, and prepared this.

[0039] Next, the screen board of 325 meshes is used for these pastes, and it is the line breadth of 150 micrometers, respectively on the top side (with no Sn adhesion) of a soda lime glass substrate. To a printing configuration with a length of 50mm, it is 15 micrometers in thickness. After screen-stenciling and drying for 10 minutes at 150 degrees C, the evaluation sample was produced by calcinating for 10 minutes at 580 degrees C.

[0040] The color tone when observing the obtained sample from the tooth-back side (field side which is not printed) of a glass substrate, a reflection factor and the reflection factor of a baking body surface, and sheet resistance were measured. The result is shown in Table 1. In addition, in the following tables, the value to which a color tone sets silver white to 1, and sets black to 5 and which evaluated the darker color in five numerical large stages was described.

[0041]

[Table 1]

[0042] The end (0.8 micrometer [of mean particle diameters], spherical particle) palladium powder of example 6-10 silver dust (0.2 micrometers of mean particle diameters) A spherical particle, the end of a glass powder (HOUKEI acid lead glass and about 450 degrees C of softening temperatures) 4 micrometers of mean particle diameters An indeterminate form particle, 2-ethyl hexanoic-acid silver (silver 43% per part), 2-ethyl hexanoic-acid palladium (palladium 27% per part), and V2 O3 Powder (2 micrometers of mean particle diameters, indeterminate form particle) And Bi 2O3 Powder (5 micrometers of mean particle diameters) was prepared with the compounding ratio as shown in Table 2. It pasted by kneading this using a kneading machine with the same organic vehicle as having used in the examples 1-5.

[0043] Next, the evaluation sample was produced by processing these pastes by the same method as examples 1-5. About the obtained sample, it evaluated like examples 1-5. The result is shown in Table 2.

[0044]

[Table 2]

[0045] End of example 11 - end of 15 silver dust (0.3 micrometer [of mean particle diameters], spherical particle), and glass powder (hoe silicic-acid lead glass, about 450 degrees-C [of softening temperatures], 4 micrometer [of mean particle diameters], indeterminate form particle), and 2-ethyl hexanoic-acid silver (silver 43% per part), 2-ethyl hexanoic-acid ruthenium (ruthenium 19% per part), and V2 O5 Powder (2 micrometers of mean particle diameters, indeterminate form particle) was prepared with the compounding ratio as shown in Table 3. It pasted by kneading this using a kneading machine with the same organic vehicle as having used in the examples 1-5.

[0046] Next, the evaluation sample was produced by processing these pastes by the same method as examples 1-5. About the obtained sample, it evaluated like examples 1-5. The result is shown in Table 3.

[0047]

[Table 3]

[0048] End of example 16 - end of 20 silver dust (0.3 micrometer [of mean particle diameters], spherical particle), and glass powder (hoe silicic-acid bismuth glass, about 500 degrees-C [of softening temperatures], 2 micrometer [of mean particle diameters], indeterminate form particle), and 2-ethyl hexanoic-acid ruthenium (ruthenium 19% per part), and V2 O5 Powder (2 micrometers of mean particle diameters, indeterminate form particle), and RuO2 Powder (0.3 micrometers of mean particle diameters) was prepared with the compounding ratio as shown in Table 4. It pasted by kneading this using a kneading machine with the same organic vehicle as having used in the examples 1-5.

[0049] Next, the evaluation sample was produced by processing these pastes by the same method as examples 1-5. About the obtained sample, it evaluated like examples 1-5. The result is shown in Table 4.

[0050]

[Table 4]

[0051] the end of an example 21 - the end of 25 silver dust (1.5 micrometers of mean particle diameters, spherical particle), and a glass powder (HOUKEI acid lead glass --) About 450 degrees C of softening temperatures, 4 micrometers of mean particle diameters An indeterminate form particle, 2-ethyl hexanoic-acid silver (silver 43% per part), 2-ethyl hexanoic-acid palladium (palladium 27% per part), and V2 O4 Powder (2 micrometers of mean particle diameters, indeterminate form particle), and Bi 2O3 Powder (5 micrometers of mean particle diameters) and CuO powder (3 micrometers of mean particle diameters) were prepared with the compounding ratio as shown in Table 5. It pasted by kneading this using a kneading machine with the photosensitive organic vehicle which dissolved methacrylic-ester system polymer, acrylic-acid-2-hydroxypropyl, benzoin butyl-ether, isopropyl thioxan ton, p-tert-butyl catechol and 2, and 6-G tert-butyl-p-cresol in the diethylene-glycol monobutyl ether, and was prepared.

[0052] Next, the screen board of 250 meshes is used for these pastes, and it is 15 micrometers in thickness on the top side (with no Sn adhesion) of a soda lime glass substrate. It screen-stenciled so that it might become, and it dried for 30 minutes at 80 degrees C. Subsequently, Na2 CO3 after exposing 500 mJ/cm2 using a phot mask so that a pattern with a line breadth of 150 micrometers may be formed, respectively The electrode pattern was produced by developing negatives for 2 minutes by solution 0.4%. The evaluation sample was produced by calcinating this for 15 minutes at 580 degrees C.

[0053] About the obtained sample, it evaluated like examples 1-5. The result is shown in Table 5.

[0054]

[Table 5]

[0055] End of example 26 - end of 30 silver dust (1.0 micrometer [of mean particle diameters], spherical particle), and glass powder (hoe silicic-acid bismuth glass, about 500 degrees-C [of softening temperatures], 2 micrometer [of mean particle diameters], indeterminate form particle), and 2-ethyl hexanoic-acid ruthenium (ruthenium 19% per part), and V2 O5 Powder (2 micrometers of mean particle diameters, indeterminate form particle), and RuO2 Powder (0.3 micrometers of mean particle diameters) was prepared with the compounding ratio as shown in Table 6. It pasted by kneading this using a kneading machine with the same photosensitive organic vehicle as having used in the examples 21-25.

[0056] Next, the evaluation sample was produced by processing these pastes by the same method as examples 21-25. About the obtained sample, it evaluated like examples 1-5. The result is shown in Table 6.

[0057]

[Table 6]

[0058] the end of an example 31 - the end of 35 silver dust (1.5 micrometers of mean particle diameters, spherical particle), and a glass powder (HOUKEI acid lead glass --) About 480 degrees C of softening temperatures, 3 micrometers of mean particle diameters An indeterminate form particle, 2-ethyl hexanoic-acid silver (silver 43% per part), 2-ethyl hexanoic-acid palladium (palladium 27% per part), and V2 O5 Powder (2 micrometers of mean particle diameters, indeterminate form particle), and Bi 2O3 Powder (5 micrometers of mean particle diameters) and CuO powder (3 micrometers of mean particle diameters) were prepared with the compounding ratio as shown in Table 7. It pasted by kneading this using a kneading machine with the organic vehicle which dissolved the ethyl cellulose in ethylene-glycol-monobutyl-ether acetic ester, and was prepared.

[0059] The screen board of 250 meshes is used for the photosensitive organic vehicle same with having used in the examples 21-25, and it is 15 micrometers in thickness on the top side (with no Sn adhesion) of a soda lime glass substrate. Solid printing was carried out so that it might become. Line breadth of 150 micrometers after drying for 30 minutes at 80 degrees C It is 70 micrometers between lines. Na2 CO3 after exposing 500 mJ/cm2 using a phot mask so that a pattern may be formed By developing negatives for 2 minutes by solution 0.4%, the pattern for electrode formation which has two or more crevices was formed. Subsequently, after pouring into the crevice the paste prepared previously using the squeegee for screen-stencil and drying for 15 minutes at 150 degrees C, the evaluation sample was produced by exfoliating and calcinating the photopolymer of heights for 10 minutes at 580 degrees C.

[0060] About the obtained sample, it evaluated like examples 1-5. The result is shown in Table 7.

[0061]

[Table 7]

[0062] End of example 36 - end of 40 silver dust (1.5 micrometer [of mean particle diameters], spherical particle), and glass powder (hoe silicic-acid lead glass, about 450 degrees-C [of softening temperatures], 4 micrometer [of mean particle diameters], indeterminate form particle), and 2-ethyl hexanoic-acid ruthenium (ruthenium 19% per part), and V2 O5 Powder (2 micrometers of mean particle diameters, indeterminate form particle), and RuO2 Powder (0.3 micrometers of mean particle diameters) was prepared with the compounding ratio as shown in Table 8. It pasted by kneading this using a kneading machine with the same organic vehicle as having used in the examples 31-35.

[0063] Next, the evaluation sample was produced by processing these pastes by the same method as examples 31-35. About the obtained sample, it evaluated like examples 1-5. The result is shown in Table 8.

[0064]

[Table 8]

[0065] As shown in one to example of comparison 3 table 9, end of glass powder and 2-ethyl hexanoic-acid palladium is used in the end of silver dust it used for examples 1-5. V2 O4 The paste of the example 1 of comparison which does not blend powder and other oxides; [The end of silver dust it used for examples 1-5,] The end of a glass powder, and V2 O4 Powder and Bi 2O3 Powder and CuO powder are used. The paste of the example 2 of comparison which does not blend a metal atom content organic compound; The end of silver dust it used for examples 11-15 at the row, 2-ethyl hexanoic-acid silver and 2-ethyl hexanoic-acid ruthenium are used in the end of a glass powder, and it is V2 O5. The paste of the example 3 of comparison which is not blended was processed by the respectively same method as examples 1-5, and the evaluation sample was produced. About the obtained sample, the same evaluation as examples 1-5 was performed. The result is shown in Table 9.

[0066]

[Table 9]

[0067] The baking object of this invention obtained in the examples 1-40 presented the dark color from which sufficient color tone and display contrast are acquired, its reflection factor of a baking body surface was fully large, was small, and showed the conductivity which was moreover excellent. [of the reflection factor by the side of a background] A result to which the baking object acquired in the examples 1-3 of comparison satisfies all color tones, the reflection factors, and electric resistance in any case was not obtained to these.

[Translation done.]

CLAIMS

[Claim(s)]

[Claim 1] (A) the [silver, gold, and] -- at least 1 sort of metal-powder; chosen from 8 group noble metals

(B) End of glass powder;.

(C) the [silver, gold, and] -- the conductive baking object which calcinates the constituent which contains the (D) vanadium oxide in the organic compound; row which contains in a molecule at least one sort of metal atoms chosen from 8 group noble metals, and is acquired

[Claim 2] The conductive baking object according to claim 1 whose (A) is at least one sort of silver and palladium.

[Claim 3] The conductive baking object according to claim 1 which is the organic compound with which (C) has in a molecule at least one sort of metals chosen from silver, palladium, and a ruthenium.

[Claim 4] furthermore, (E) -- conductive baking object according to claim 1 which blended following metal multiple-oxide Cr-Co-Mn-Fe, Cr-Cu, Cr-Cu-Mn, Mn-Fe-Cu, and at least one sort of metallic oxides chosen from Cr-Co-Fe;(FeO) x(Fe 2O3) y Ferric acid ghost;MnO2 expressed ; MoO2 ; Cr 2O3 ; CuO;PdO;RuO2 ; And Bi 2O3

[Claim 5] The electrode which consists of a conductive baking object according to claim 1.

[Claim 6] The discharge-in-gases display panel to which this bus electrode is characterized by being an electrode according to claim 5 in the alternated type discharge-in-gases display panel equipped with the dielectric layer and protective layer which were prepared in the inside of the substrate of the couple which carries out phase opposite on both sides of discharge space, and one [at least] substrate, and were prepared in the electric discharge maintenance electrode which consists of a transparent electrode and a bus electrode, and the row one by one inside this electric discharge maintenance electrode.

[Claim 7] The discharge-in-gases display panel according to claim 6 to which pattern formation of the bus electrode was carried out.

[Claim 8] The discharge-in-gases display panel to which this anode plate is characterized by being an electrode according to claim 5 in the flowed-in one direction type discharge-in-gases display panel equipped with the anode plate prepared in the inside of the substrate of the couple which carries out phase opposite on both sides of discharge space, and one [at least] substrate,

and the cathode prepared in the inside of the substrate of another side.

[Claim 9] The discharge-in-gases display panel according to claim 8 to which pattern formation of the anode plate was carried out.

[Translation done.]

[Brief Description of the Drawings]

[Drawing 1] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3E%3C76%3C%2F%2F%2F%26N0001%3D727%26N0552%3D9%26N0553%3D000011> It is the perspective diagram showing the basic structure of a typical discharge-in-gases display panel.

[Description of Notations]

1 Screen Side Substrate

2 Tooth-Back Side Substrate

3 Transparent Electrode

4 Bus Electrode

5 Dielectric Layer

6 Protective Layer

7 Dielectric Layer

8 Address Electrode

9 Septum

10 Fluorescent Substance

11 Observer

[Translation done

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the technology which suppresses discoloration of the float glass substrate especially used for the front panel of PDP about a plasma display panel ("PDP" is called below).

[0002]

[Description of the Prior Art] Drawing 5 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000007> is drawing of longitudinal section showing an example of the structure of the conventional PDP, and this structure is proposed by for example, ** JP,3-190039,A.

[0003] drawing 5 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000007> -- setting -- 101 -- the 1st insulating substrate and 102 -- the 2nd insulating substrate and 104 -- a train electrode and 105 -- discharge-gas space and 106 -- a fluorescent substance and 108 show the insulator and, as for a protective coat and 113a, a transparent electrode (for example, since it consists of SnO2 film, it is called "SnO2 film 113a" below), and 113b show [a septum and 107 / 109] the metal auxiliary electrode Moreover, transparent-electrode 113a and metal auxiliary-electrode 113b are named the line electrode 113 generically. Moreover, the structure of PDP can be divided roughly into the front panel 131 which consists of the 1st insulating substrate 101, line electrode 113, insulator 108, and protective coat 109, and the back panel 132 which consists of the 2nd insulating substrate 102, train electrode 104, fluorescent substance 107, and septum 106 as shown in drawing 5 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000007> .

[0004] As for the 1st and 2nd insulating substrates 101,102, a soda glass is used in many cases from the cheapness (it is called below "the 1st glass substrate 101" and the "2nd glass substrate 102", respectively). Therefore, diffusion of alkali-metal ion, such as sodium (Na) which a soda glass contains, is prevented by coating the front-face top of the 1st glass substrate 101 with the alkali barrier layer 110 like the front panel 141 which has other structures of the conventional PDP shown in drawing 6 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%

3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000008> instead of the front panel 131 of drawing 5 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000007> . The same is said of the 2nd glass substrate 102.

[0005] Now, in the conventional PDP shown in drawing 5 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000007> or drawing 6 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000008> , the thick-film Ag film (it is called below "thick-film Ag film 113b" and "Ag auxiliary-electrode 113b") is used abundantly as metal auxiliary-electrode 113b. Generally as the formation method of this thick-film Ag film 113b, the method using Ag paste and the method (the dry film method) using what was fabricated with organic binders, such as a dry film, are used like screen printing or the roll coat method. By screen printing or the roll coat method, as Ag of the shape of a paste kneaded by the organic solvent, and Ag of the configuration fabricated with the organic binder in the dry film method, it is supplied on transparent-electrode 113a, and Ag pattern is formed. For this reason, when forming Ag auxiliary-electrode 113b using these formation methods, in order to remove the organic component which is the above-mentioned solvent or a binder and to form Ag auxiliary-electrode 113b, the need of usually calcinating at the elevated temperature of about 500 degrees C is after Ag pattern formation.

[0006]

[Problem(s) to be Solved by the Invention] Now, as a glass substrate 101,102 of PDP shown in drawing 5 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000007> , the soda glass is used abundantly as mentioned above from the reasons of that the enlargement is comparatively easy, being able to attain low-cost-ization. This soda glass is slushed on the tin (Sn) which is fusing the raw materials for glass melted by the smelter at the elevated temperature (bus of Melting Sn), and is manufactured by floating on Melting Sn by the float glass process formed in a plate. Hereafter, the soda glass manufactured by this manufacture method is only called a "float glass."

[0007] As mentioned above, the surface which consists of composition containing Sn exists in the front face (a "bottom side" is called below) of the side which touches Melting Sn in the manufacturing process among the front faces of the float glass concerned. Moreover, the surface which changes from composition containing Sn also to the front face (a "top side" is called below) of the side which does not touch the above-mentioned melting Sn exists, and the surface

concerned originates in the wraparound of the steam of Melting Sn so that it may be pointed out to Table 1 in precedence reference ** indicated by 146 pages - 150 pages of Collected papers and XIV Intl.Congr.on Glass (1986). Therefore, as for both the front faces (a bottom side, top side) of a float glass, Sn exists in the surface.

[0008] Moreover, in the formation process of Ag auxiliary-electrode 113b shown in drawing 5 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000007> or drawing 6 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000008> , if heat treatment of the long time (beyond about -30 minute) in an elevated temperature which exceeds 500 degrees C for example, in the atmosphere is performed as heat treatment for baking, such as Ag paste, Ag ion will be spread in a glass substrate 101 from Ag auxiliary-electrode 113b. When the above-mentioned float glass is used as a glass substrate 101 at this time ("the float glass substrate 101" is called below), Ag ion diffused in a glass substrate 101 reacts with divalent Sn (Sn++) which exists in the above-mentioned surface of the float glass substrate 101, Ag ion is returned (Ag+->Ag), and it is set to Ag of colloid. Since Ag of this colloid has the property which absorbs about 400nm light, it will make the whole surface of the float glass substrate 101 yellow. Therefore, according to this yellowing, the balance of the luminescent color of original from the fluorescent substance of PDP collapses, and the trouble that expression of an exact color is not obtained arises. This point is explained in detail using drawing 7 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000009> .

[0009] Ag ion in Ag auxiliary-electrode 113b is typical drawing of longitudinal section of PDP showing signs that it is spread to the float glass substrate 101, and drawing 7 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000009> is equivalent to the state of the stage where Ag auxiliary-electrode 113b was formed, in the manufacturing process of the front panel 141 exactly shown in drawing 6 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000008> . Among drawing 7 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000009> , 120 pass SnO2 film (transparent electrode) 113a and the alkali barrier layer 110 from Ag auxiliary-electrode 113b, reach the float glass substrate 101, and show tracing (movement) of Ag ion ("the

Ag ion 120" is called below) diffused inside also exceeding the surface 101S. On the other hand, although 123 penetrates SnO2 film 113a and the alkali barrier layer 110 like the tracing 120 of Ag ion, tracing (movement) of Ag ion ("the Ag ion 123" is called below) by which a trap is carried out by producing divalent Sn122 and the divalent reduction reaction which are included in the surface 101S after reaching the float glass substrate 101 is shown. Moreover, 121 shows tracing (movement) of Ag ion ("the Ag ion 121" is called below) in which a trap is carried out into transparent-electrode film 113a by the reduction reaction with divalent Sn122 inside SnO2 film 113a. In addition, 124 shows tetravalent Sn contained in SnO2 film 113a or the float glass substrate 101. Since this tetravalent Sn124 is the stable state of Sn atom in Sn compound, it does not cause a reduction reaction with Ag ion. Therefore, as a cause of yellowing of the above-mentioned float glass substrate 101, the reduction reaction of divalent Sn and the three above-mentioned kinds of Ag ion 120,121,123 can be considered.

[0010] Among the three above-mentioned kinds of Ag ion 120,121,123, since the Ag ion 120 arrives at the glass-substrate 101 interior, without reacting with Sn122 in surface 101S, Ag of colloid does not arise, therefore yellowing of the above-mentioned glass substrate 101 is not observed. On the other hand, although the Ag ion 121 generates Ag of colloid by the reduction reaction with Sn122 in SnO2 film 113a The thickness of SnO2 film 113a is about about 0.2 micrometers, and most things for which yellowing of the SnO2 **** 113a itself will be observed in PDP even if it yellows, since it is very thin compared with the thickness (about several 10 micrometers) of surface 101S of the float glass substrate 101 cannot be found.

[0011] Therefore, it turns out that the cause of yellowing of the float glass substrate 101 is the reduction reaction of divalent Sn122 in surface 101S, and the Ag ion 123. In addition, about discoloration of the glass by the reaction of such Ag ion and Sn in a float glass, explanation of the fundamental analysis can be seen to the above-mentioned precedence reference **.

[0012] Moreover, being caused by the elevated-temperature heat treatment process not only in the above-mentioned elevated-temperature baking process of Ag auxiliary-electrode 113b but the elevated-temperature heat treatment process after formation of Ag auxiliary-electrode 113b, for example, the baking process of the insulator (dielectric) layer 108 (refer to drawing 6 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000008>), the sealing process of the front panel of PDP and a back panel, etc., etc. can guess the diffusion phenomenon of above-mentioned Ag ion easily.

[0013] It is possible to use also for PDP the alkali free glass which originates in Ag of above-mentioned colloid and is used as a substrate of a liquid crystal panel as one of the solutions of the trouble that the exact luminescent color of PDP is not obtained and which does not contain Sn on a front face. However, since PDP has the predominance in the place which is the display which neither a liquid crystal panel nor CRT can realize easily, and which can realize the large-sized flat TV of 40 inches - 60 inch class, its large-sized glass substrate is indispensable as a material. It cannot perform adopting an expensive alkali free glass as a glass substrate for PDP, if an example is taken in this point at all, but a conclusion that it cannot think other than a float glass

as a glass substrate with which may be satisfied of a demand called the possibility of enlargement of the glass substrate for which the glass substrate for PDP is asked, low-cost-izing, and mass-production correspondence is reached. Therefore, even if it uses a float glass substrate as a glass substrate for PDP, it is required to take the cure which the yellowing does not produce.

[0014] This invention is made in order to cancel the trouble resulting from yellowing of an above-mentioned float glass substrate, and it sets it as the 1st purpose to offer the glass substrate for PDP from which Sn which exists in the surface of a float glass substrate by the simple and low cost method is removed, and its manufacture method.

[0015] Furthermore, it sets it as the 2nd purpose to offer PDP whose display quality improved as compared with the conventional PDP by having the float glass substrate obtained by achievement of the 1st purpose.

[0016]

[Means for Solving the Problem] (1) The glass substrate for plasma display panels concerning invention according to claim 1 is characterized by removing Sn which exists in one [at least] front-face side by predetermined processing in the glass substrate manufactured by the float glass process.

[0017] (2) The glass substrate for plasma display panels concerning invention according to claim 2 is characterized by the aforementioned predetermined processing being processing which removes Above Sn by flooding with a predetermined etching solution in a glass substrate for plasma display panels according to claim 1.

[0018] (3) The glass substrate for plasma display panels concerning invention according to claim 3 is a glass substrate for plasma display panels according to claim 1, and is characterized by the aforementioned predetermined processing being processing which removes Above Sn by mechanical means.

[0019] (4) The glass substrate for plasma display panels concerning invention according to claim 4 is characterized by the aforementioned predetermined processing being processing which removes a field with a thickness of about at least 10 micrometers from aforementioned one front-face side in a glass substrate for plasma display panels according to claim 2 or 3.

[0020] (5) The plasma display panel concerning invention according to claim 5 is characterized by having a glass substrate for plasma display panels according to claim 1 to 4, SnO2 film formed on aforementioned one front face of the aforementioned glass substrate for plasma display panels, and Ag auxiliary electrode formed on the front face of the SnO2 aforementioned film.

[0021] (6) one [at least] front-face side of the aforementioned glass substrate after the manufacture method of the glass substrate for plasma display panels concerning invention according to claim 6 manufactures a glass substrate by the float glass process -- receiving -- predetermined processing -- carrying out -- the above -- it is characterized by removing Sn which

exists in one front-face side even if few

[0022]

[Embodiments of the Invention] (Form 1 of operation)

(Focus) The need for a cure over generating of yellowing of the meaning of using the glass (a "float glass" being called below) manufactured by the float glass process as a glass substrate for PDP and the float glass substrate concerned is as stated above.

[0023] The cure of preventing the diffusion to the float glass substrate of Ag ion can be considered by coating the alkali barrier layer (alkali barrier layer 110 reference of drawing 7 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000009>) which consists of SiO2 on the front face of a float glass substrate as one of the above-mentioned cures. However, although SiO2 film used as an alkali barrier layer was effective in preventing diffusion of the alkali-metal ion in a glass substrate, not accepting made clear most barrier effects over Ag ion by research of an invention-in-this-application person.

[0024] Next, the solution of not making low temperature-ization of the whole manufacture process of the whole surface panel of PDP generate Ag ion especially can be considered. Like previous statement, elevated-temperature heat treatment at the formation process of the above-mentioned Ag auxiliary electrode is heat treatment for removing the organic solvent under Ag paste etc. Therefore, if Ag auxiliary electrode is formed with the photolithography technology which is not based on the screen printing which needs this elevated-temperature heat treatment, but is used abundantly by the manufacturing process of a semiconductor device, low-temperature formation of Ag auxiliary electrode is possible. Furthermore, it is not impossible by performing more baking heat treatment of the glass paste in high temperature down stream processing after formation of Ag auxiliary electrode, for example, the formation process of an insulator (dielectric) layer (108 references of drawing 6 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000008>) and the sealing process of a front panel and a back panel, at low temperature (for example, below 400 degreeC) to form the whole PDP manufacturing process into a low-temperature process, either. however, although about [that the number of processes for forming Ag auxiliary electrode by using photolithography technology increases] and the technology concerned is the technology fully established in the semiconductor field, when it uses as a manufacture process of PDP, a cost merit is small, and the further low-cost-ization of technology own [concerned] will be considered if it can hardly wish Moreover, when the baking process of a glass paste is low-temperature-ized, it is a question whether the property required of the glass paste concerned sure enough can fully be demonstrated. Therefore, it sees cost-wise [this solution] and technically and it can be said that the adoption is difficult.

[0025] If it looks back upon the above consideration, the chief aim is put on all preventing or suppressing diffusion of Ag ion. Then, the invention-in-this-application person found out the solution of the problem of the above-mentioned yellowing of a glass substrate by perceiving again the reaction of divalent Sn contained in the front face of the above-mentioned float glass substrate and Ag ion generated from Ag auxiliary electrode which caused the phenomenon of yellowing of the above-mentioned glass substrate itself. That is, it came to acquire the idea of removing the above-mentioned divalent Sn contained on the front face of not the above-mentioned Ag ion but a float glass substrate.
 [0026] Drawing 1 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000003> is drawing showing typically the fundamental view of the invention in this application obtained by above-mentioned examination. Drawing 1 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000003> is drawing of longitudinal section of the front panel of PDP using the glass substrate 1 for PDP from which Sn which exists on the surface of a float glass by the manufacture method of the glass substrate for PDP mentioned later was removed, and shows the state of the stage where even Ag auxiliary-electrode 13b was formed in the manufacturing process. Drawing 1 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000003> is equivalent to drawing 7 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000009> which shows the front panel of the conventional PDP using the float glass substrate containing Sn to the front face, and it becomes clear [the difference between the invention in this application and a Prior art] by comparing both in the following explanation much more [it]. Moreover, as shown in drawing 1 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000003> , the alkali barrier layer 10 is formed on one front face of the ** glass substrate 1 above-mentioned [PDP], and SnO2 film 13a and Ag auxiliary-electrode 13b which are a transparent electrode are formed on the front face of the alkali barrier layer 10 concerned. In addition, in the invention in this application, it can be said that it is desirable although the alkali barrier layer 10 is not an indispensable component. [of having the alkali barrier layer 10 concerned in PDP, since it has a function as stated above]

[0027] Among drawing 1 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000003> , 20 pass SnO2 film 13a and the alkali barrier layer 10

from Ag auxiliary-electrode 13b, and reach a glass substrate 1, the locus (movement) of Ag ion ("the Ag ion 20" is called below) diffused to the interior is shown, and the Ag ion 20 can be contrasted with the Ag ion 120 shown in drawing 7 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000009> . Moreover, 21 show the locus (movement) of Ag ion ("the Ag ion 21" is called below) by which a trap is carried out into transparent-electrode film 13a among drawing 1 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000003> by the reduction reaction with divalent Sn22 inside SnO2 film 13a, and the Ag ion 21 can be contrasted with the Ag ion 121 shown in drawing 7 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000009> . In addition, 24 shows tetravalent Sn contained in SnO2 film 13a.

[0028] Here, please understand that Sn like surface 101S of drawing 7 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000009> , especially divalent Sn (Sn122 divalent reference shown in drawing 7 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000009>) to which Ag ion is made to return do not exist in the front face of the glass substrate 1 for PDP shown in drawing 1 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000003> . Therefore, since Sn will not exist in the front face of the glass substrate 1 of drawing 1 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000003> at all even if Ag ion reaches to a glass substrate 1 and is spread to the interior, the Ag ion concerned does not cause divalent Sn and a divalent reduction reaction like the Ag ion 123 of drawing 7 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000009> . That is, the Ag ion concerned is exactly the Ag ion 20 which does not contribute to yellowing of a glass substrate. Therefore, in PDP equipped with the glass substrate 1 for PDP, the effect that the problem of yellowing of the glass substrate which the conventional PDP equipped with the float glass substrate containing Sn holds

in the front face does not arise at all is done so.

[0029] The manufacture method of the above glass substrate for PDP is explained in full detail below.

[0030] (The manufacture method of the glass substrate for PDP concerning the form 1 of operation) Now, what is necessary is just to remove Sn which exists in the near front face in which Ag auxiliary-electrode 13b etc. is formed at least among both the front faces of the glass substrate 1 for PDP, in order to realize above-mentioned composition. Like previous statement, the float glass used as a glass substrate for PDP originates in the manufacture method, and the top side and the bottom side contain Sn as composition on the surface. However, since it is only that a top side contacts Sn steam around which does not contact Sn bus directly but it turns to it from Sn bus, there are few the contents as compared with a bottom side. This difference can be seen also in Table 1 in precedence reference ** mentioned already.

[0031] Therefore, after removing Sn which chooses a top side side as one [at least] front-face side, and exists in the surface (namely, field of thickness fixed from a front face and a front face), it is suitable from a viewpoint of the throughput to form the component of PDP(s), such as SnO2 film 13a and Ag auxiliary-electrode 13b, on this front face in the manufacturing process of PDP. Drawing 4 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000006> is Sn concentration (wt%) profile turned to the interior from the front face of the top side of the float glass substrate measured based on this viewpoint. In addition, drawing 4 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000006> is data based on SIMS (Secondary Ion Mass Spectroscopy:ion [secondary] mass spectrograph). According to drawing 4 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000006> , about 0.044% of Sn is contained in the maximum front face of a top side, and Sn concentration decreases according to the depth direction. moreover -- if a field with a thickness of about 5 micrometers is removed from a front face -- about 0.01 -- if Sn can be removed to wt% (about 80%) grade and even the field of the thickness which is about 10 micrometers is removed -- about 0.004 -- it turns out that Sn is removable to wt% (about 90%) grade In addition, as compared with a top side, about 5 times as many Sn as this exists in a bottom side, and the depth of the distribution adds knowledge that it amounts to about about 50 micrometers to it.

[0032] The art which removes Sn of a float glass substrate which exists in the surface by the side of a top side at least by flooding with a predetermined etching solution is explained using drawing 2 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%

3D9%26N0553%3D000004> based on the data of drawing 4 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000006> .

[0033] (a) - (c) of drawing 2 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000004> is drawing showing the manufacture method of the glass substrate for PDP concerning the form 1 of this operation, 51 is a float glass substrate and the top side and 51B show [51T] the bottom side. Moreover, 52 shows an etching tub and 53 shows a fluoric acid solution.

[0034] As shown in (a) of drawing 2 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000004> , divalent and tetravalent Sn 22 and 24 exists in both top side 51T and bottom side 51B of the float glass substrate 51. The surface of the float glass substrate 51 in which Sn 22 and 24 is contained is **********ed by flooding the float glass substrate 51 of this state with the fluoric acid solution 53 in the etching tub 52, as shown in (b) of drawing 2 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000004> . Thus, the glass substrate 1 for PDP which is shown in (c) of drawing 2 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000004> and which does not contain Sn in the surface can be obtained. In addition, in (c) of drawing 2 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000004> , although Sn which exists in both sides of top side 51T and bottom side 51B is removed, it is as above-mentioned that what is necessary is just to remove Sn which exists in one [at least] front face (top side 51T) by etching. In this case, yellowing of a glass substrate is removable by following and removing Sn to a 0.004wt(s)% content at least even to the grade which does not pose a display performance top problem of PDP by **********ing a field with a thickness [of top side 51T] of about at least 10 micrometers.

[0035] Moreover, even if it uses a sodium-hydroxide solution instead of the above-mentioned fluoric acid solution 53, the effect that yellowing of a glass substrate is removable similarly can be acquired. However, since the etch rate is comparatively loose when a sodium-hydroxide solution is used, the above-mentioned processing using a fluoric acid solution can be called more desirable form. Moreover, if an example is taken by the essence of this manufacture method that etching removes Sn which exists in the front-face side of a float glass, as an etching solution, it will not be restricted to an above-mentioned fluoric acid solution or an above-mentioned sodium-

hydroxide solution. Therefore, if the solution which may ********** a front face including Above Sn is defined as "a predetermined etching solution", it can be said that the above-mentioned manufacture method is "an art which removes Above Sn by flooding with a predetermined etching solution."

[0036] As mentioned above, since Sn which is the cause of yellowing of a glass substrate is easily [certainly and] removable only by doing the work of flooding a glass substrate with a predetermined etching solution according to this manufacture method of the glass substrate for PDP, it can be said that the manufacture method concerned is an art with a large cost merit.

[0037] Furthermore, according to this manufacture method, the effect described below can also be acquired.

[0038] If the portions which contain many divalent Sn22 in SnO2 film 13a of drawing 1 are scattered on the whole surface of PDP, although the nonuniformity of the display which originates in the difference of the reacting weight of Sn22 and the Ag ion 21 between a portion with much Sn22 and a few portion may be observed By using the glass substrate 1 for PDP concerning the form 1 of this operation as a glass substrate of PDP, the above-mentioned nonuniformity produces the effect that it can decrease even to the grade hardly observed no longer. The uneven distribution of divalent Sn22 in such SnO2 film 13a originates in decomposition with the inadequate raw material of the ununiformity within a field of glass-substrate temperature, or SnO2 film, the shortage of the amount of oxygen at the time of blasting, etc. in the membrane formation process by the heat CVD of for example, SnO2 film. Thus, although many production control elements must be cared about at the membrane formation process of SnO2 film, it is also possible to absorb the instability of the above-mentioned production control element by using the glass substrate 1 for PDP applied to the form 1 of this operation as a glass substrate of PDP.

[0039] In addition, according to this manufacture method, in order that being immersed [solution / etching / predetermined] may ease the keen micro crack which exists in the front face of a float glass substrate, the glass substrate 1 for PDP obtained after above-mentioned being immersed also includes the effect that the intensity improves, as compared with the conventional float glass substrate.

[0040] (Modification of the form 1 of operation) The modification of the form 1 of this operation carries out the idea "removal of Sn which exists in the surface of a float glass" in the form 1 of the above-mentioned implementation, by mechanical means, such as buffing. The manufacture method of the glass substrate for PDP which uses drawing 3 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000005> below and is applied to the modification of the form 1 of this operation is explained.

[0041] (a) - (c) of drawing 3 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%

3D341%26N0552%3D9%26N0553%3D000005> is the ** type view showing the manufacture method of the glass substrate for PDP concerning the modification of the form 1 of this operation. Top side 51T and bottom side 51B which has Sn 22 and 24 of the float glass substrate 51 shown in (a) of drawing 3 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000005> is ground with the polish board 60 which rotates with rotation of a medial axis 61 as shown in (b) of drawing 3 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000005> . Thus, the glass substrate 1 for PDP which does not contain Sn can be obtained on the front face shown in (c) of drawing 3 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000005> .

[0042] In addition, in (b) of drawing 3 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D341%26N0552%3D9%26N0553%3D000005> , although both sides 51T and 51B of the float glass substrate 51 are ground, it is as stated above that it is more suitable to grind top side 51T that what is necessary is just to grind one [at least] front face. Moreover, the amount of polishes in this case can acquire the same effect as the manufacture method of the glass substrate for PDP concerning the form 1 of above-mentioned operation, if a field with a thickness [of top side 51T] of about at least 10 micrometers is ground.

[0043] In addition, since according to the above-mentioned buffing field relative roughness of a maximum of 1 micrometer or less can be realized and high substrate parallelism of several micrometers or less can also be realized easily, it also has the effect that the glass substrate for PDP from which curvature and irregularity were removed can be obtained.

[0044] Moreover, you may use other mechanical means, such as blasting used instead of the above-mentioned grinding method at the formation process of the septum in PDP.

[0045]

[Effect of the Invention] According to invention according to claim 1, (1) The glass substrate for plasma display panels ("PDP" is called below) Since Sn which exists in one [at least] front face of the glass substrate (a "float glass substrate" is called below) manufactured by the float glass process is removed by predetermined processing, Like the conventional PDP which uses a float glass [that Sn has existed in the front face] substrate as a glass substrate for PDP as it is, and forms a transparent electrode and Ag auxiliary electrode one by one on the glass substrate for PDP concerned Divalent Sn and Ag ion of Ag auxiliary electrode which exist in one front-face side of a float glass substrate do not cause a reduction reaction. Therefore, the effect that yellowing of the glass substrate resulting from Ag of the colloid produced by the above-

mentioned reduction reaction does not occur at all even if it uses the glass substrate by this invention for the glass substrate for PDP can be acquired.

[0046] (2) in order to remove Sn which exists in the front-face side by only flooding a float glass substrate with a predetermined etching solution according to invention according to claim 2, it has the effect that Above Sn is easily [certainly and] removable, by the effect which is the above (1), simultaneously the method that a cost merit is large

[0047] In addition, in order that being immersed [solution / etching / predetermined] may ease the keen micro crack which exists in the front face of a float glass substrate, the glass substrate for PDP obtained after above-mentioned being immersed also includes the effect that the intensity improves, as compared with the conventional float glass substrate.

[0048] (3) In order to remove Sn which exists in the front face of a float glass substrate by mechanical means according to invention according to claim 3, the same effect as the above (1) is acquired.

[0049] In addition, since mechanical means can realize field relative roughness of a maximum of 1 micrometer or less and can also realize easily high substrate parallelism of several micrometers or less, they can also include the effect that the curvature and irregularity of a glass substrate are removable.

[0050] (4) according to invention according to claim 4, in order to remove a field with a thickness of about at least 10 micrometers from one front face of a float glass substrate, it has the effect that Sn which exists in the effect, simultaneously the front face concerned of the above (2) is certainly removable to the grade from which yellowing which is the glass substrate of PDP does not pose a problem

[0051] (5) According to invention according to claim 5, PDP which has the above (1) or the same effect as (4) can be obtained.

[0052] furthermore -- even if the effect that yellowing of a glass substrate does not generate the PDP concerned at all is the case where the uneven concentration distribution of divalent Sn arises in SnO2 film according to invention according to claim 5 -- the above -- the display nonuniformity of PDP resulting from an uneven concentration distribution does so the effect that it can decrease even to the grade hardly observed That is, yellowing of a glass substrate and display nonuniformity of PDP are removed and reduced, and PDP concerning invention according to claim 5 can be said to be PDP whose display quality improved by leaps and bounds as compared with the conventional PDP which uses a float glass substrate as it is.

[0053] (6) According to invention according to claim 6, the same effect as the above (1) can be acquired.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D238%26N0552%3D9%26N0553%3D000003> It is drawing in the plasma display panel concerning the gestalt 1 of operation of this invention showing the diffusion state of Ag ion typically.

[Drawing 2] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D238%26N0552%3D9%26N0553%3D000004> It is process drawing showing the art of the glass substrate for plasma display panels concerning the gestalt 1 of operation of this invention.

[Drawing 3] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D238%26N0552%3D9%26N0553%3D000005> It is process drawing showing the art of the glass substrate for plasma display panels concerning the gestalt 2 of operation of this invention.

[Drawing 4] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D238%26N0552%3D9%26N0553%3D000006> It is drawing showing the relation between the depth from the front face by the side of the top side of a float glass substrate, and Sn concentration.

[Drawing 5] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D238%26N0552%3D9%26N0553%3D000007> It is drawing of longitudinal section showing the composition of the conventional plasma display panel.

[Drawing 6] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D238%26N0552%3D9%26N0553%3D000008> It is drawing of longitudinal section showing a part of composition

of other conventional plasma display panels.

[Drawing 7] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3E%3D%3B9%3D%3C7%2F%2F%2F%26N0001%3D238%26N0552%3D9%26N0553%3D000009> It is drawing in other conventional plasma display panels showing the diffusion state of Ag ion typically.

[Description of Notations]

1 Glass substrate for plasma display panels, 13a SnO2 film, 13bAg auxiliary electrode, 22 Divalent Sn, 24 Tetravalent Sn, 51 A float glass substrate, 51T Top side of a float glass substrate, 51B The bottom side of a float glass substrate, 52 An etching tub, 53 A fluoric acid solution, 60 A polish board, 61 Medial axis of a grinder.

[Translation done.]

CLAIMS

[Claim(s)]

[Claim 1] The glass substrate for plasma display panels characterized by removing Sn which exists in one [at least] front-face side by predetermined processing in the glass substrate manufactured by the float glass process.

[Claim 2] The glass substrate for plasma display panels characterized by the aforementioned predetermined processing being processing which removes Above Sn by flooding with a predetermined etching solution in a glass substrate for plasma display panels according to claim 1.

[Claim 3] The glass substrate for plasma display panels characterized by being a glass substrate for plasma display panels according to claim 1, and the aforementioned predetermined processing being processing which removes Above Sn by mechanical means.

[Claim 4] The glass substrate for plasma display panels characterized by the aforementioned predetermined processing being processing which removes a field with a thickness of about at least 10 micrometers from aforementioned one front-face side in a glass substrate for plasma display panels according to claim 2 or 3.

[Claim 5] The plasma display panel characterized by having a glass substrate for plasma display panels according to claim 1 to 4, SnO2 film formed on aforementioned one front face of the

aforementioned glass substrate for plasma display panels, and Ag auxiliary electrode formed on the front face of the SnO2 aforementioned film.

[Claim 6] one [at least] front-face side of the aforementioned glass substrate after manufacturing a glass substrate by the float glass process -- receiving -- predetermined processing -- carrying out -- the above -- the manufacture method of a glass substrate for plasma display panels characterized by removing Sn which exists in one front-face side even if few

[Translation done.]